ICE 2002

Bolivia Iturralde Crater Expedition

NASA/GSFC, MUSEO NOEL KEMPFF MERCADO, CONSERVATION INTERNATIONAL, NASA MU-SPIN, CASE-WEST VIRGINIA, BLUE ICE INTERNATIONAL

AUGUST 17, 2002

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INTRODUCTION

Impact craters can be found decorating the surface of solid bodies in the Solar System. On earth they are found on all the continents, however tectonics and fluvial and aeolian processes tend to mask the evidence of impact rendering the discovery and verification of the impact site akin to a detective story. The effects of impact are now recognized to be important to the interpretation of the biological and geological history of the Earth, consequently the circular feature called the **Iturralde** structure is an obvious subject of scientific interest. Located in the Bolivian Amazon, the Iturralde structure shows strong circumstantial evidence for being a crater. It will fall to ICE 2002 to verify that it is a crater. ICE 2002 will visit the site and sample the soil for later analysis, evaluate the flora within and outside the "crater", look for evidence of exotic fragments including a search for glassy particles and magnetic particles. We will use ground based and MAGPLANE surveys to look for a magnetic signature associated with the 8 kilometer circular structure.

Bolivia **Iturralde Crater Expedition 2002 (ICE2002)** is a NASA Goddard Space Flight Center expedition with the main funding source being the NASA/GSFC Directors Discretionary Fund (DDF) for Education. Consequently this expedition from the onset is a science/education event. Thus the teacher professional development program called **Teacher as Scientist (TAS)** is an important element in the design of the expedition. Additional funding comes from NASA MU-SPIN and code 713 at the NASA/GSFC. The MAGPLANE funding is due to NASA/GSFC code 935 with additional support from NASA Wallops. The MAGPLANE magnetometers are due to the magnetometer team (NASA/GSFC code 695) led by Dr. Mario Acuna.

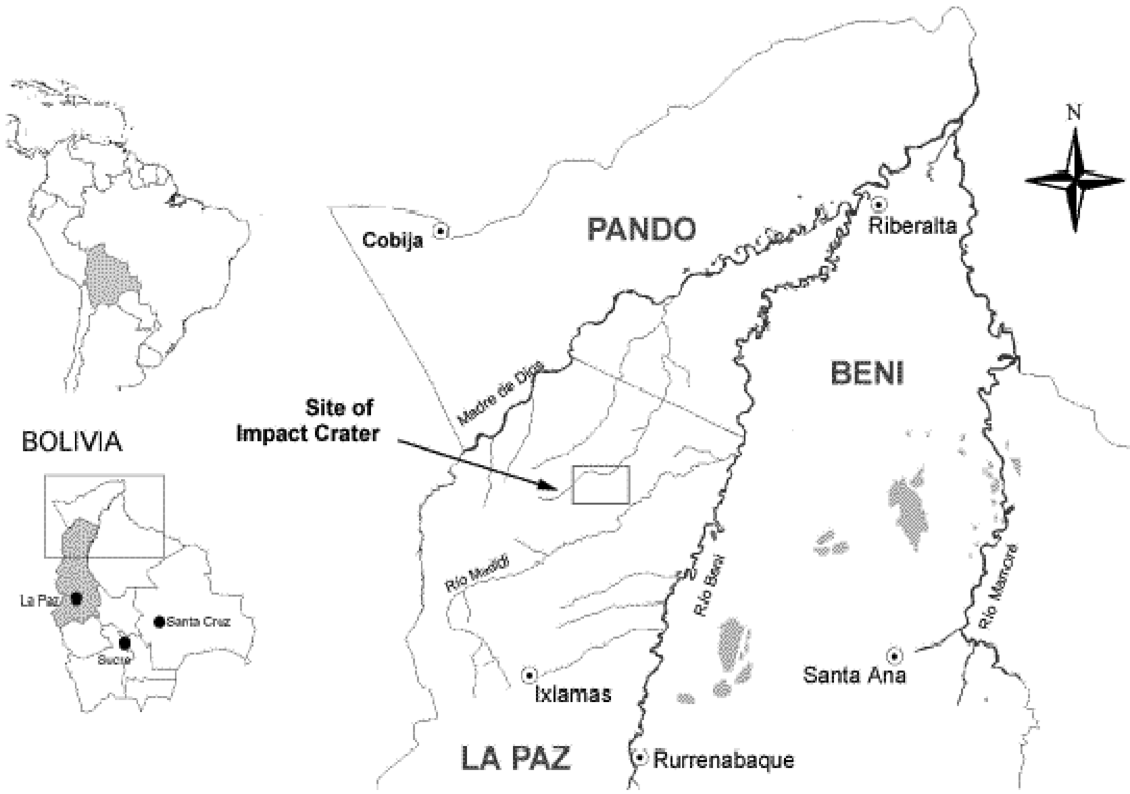
A memorandum of understanding exists between NASA headquarters and the Museo Noel Kempff in Santa Cruz Bolivia.

The expedition would not be possible without the supervision and assistance of the men in Bolivia- Dr. Tim Killeen from Museo Noel Kempff Mercado and Conservation International and Teddy M. Siles Lazzo from Museo de Historia Natural "Noel Kempff Mercado".

Any web site information and all data from the expedition will be located at http://www.blueiceonline.com

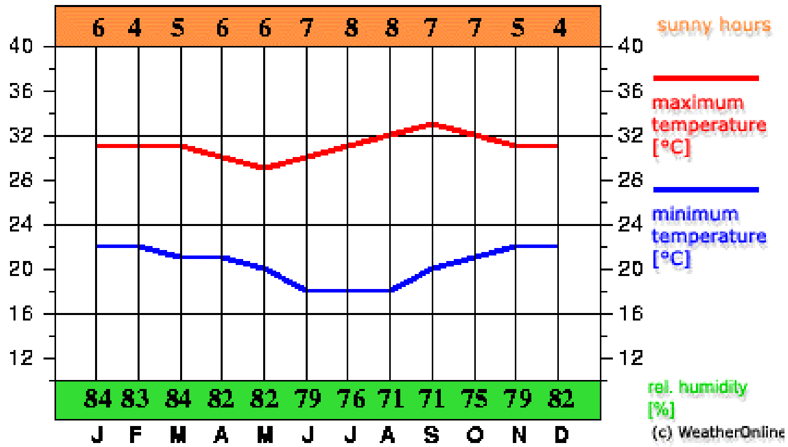
The website support is due to Community Action of Southeastern West Virginia WV (CASE WV).

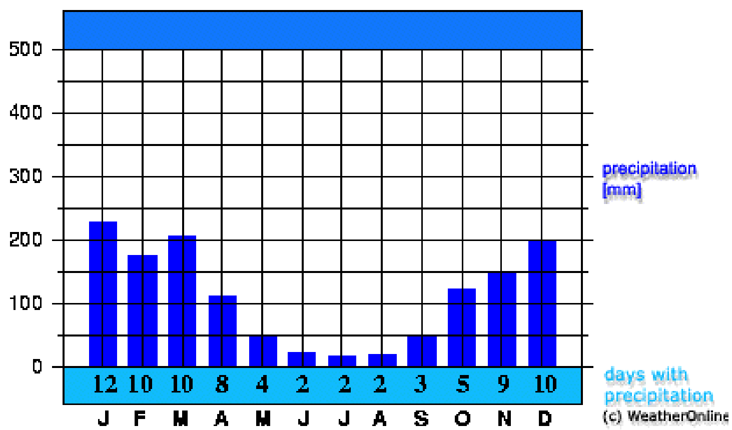
LOCATING THE ITURRALDE SITE **Figure 1**



CLIMATE NEAR THE EXPEDITION SITE

Riberalta weather about 250km from the crater site **Figure 2**
http://weatheronline.co.uk/bolivia/riberalta.htm
The climate is characterized as having a "dry" season that starts in the month of May until October, and a "rainy" season that goes from November until April. During the dry season there are sporadic cold fronts call "surazos", where the temperature drops and is, complemented by a considerable level of humidity. The winds of these fronts average 50 km/h. This Surazo is a cold wind blowing from Patagonia and the Argentine Pampa which has its origin further south.





PREVIOUS WORK

In perhaps the remotest and wildest part of the Bolivian lowlands, in an area hundreds of kilometers from the closest town, NASA scientists have identified what they believe to be the youngest complex meteorite impact crater on earth. Based on what is known about the geology of the region, they believe the meteorite slammed into the Earth sometime between 5,000 and 20,000 years ago, making it the youngest "large" impact crater on Earth. The crater is approximately 8 km across and is unique in that the target material was soft sediment

The crater was originally identified in the mid-1980s with satellite imagery, but a previous attempt to visit the site in 1987 was unsuccessful due to the remoteness of the locality. However Campbell et al (1989- National Geographic Research 5(4): 495-499) were able to make an excellent circumstantial case for an impact origin for the Iturralde structure based on the following observations:

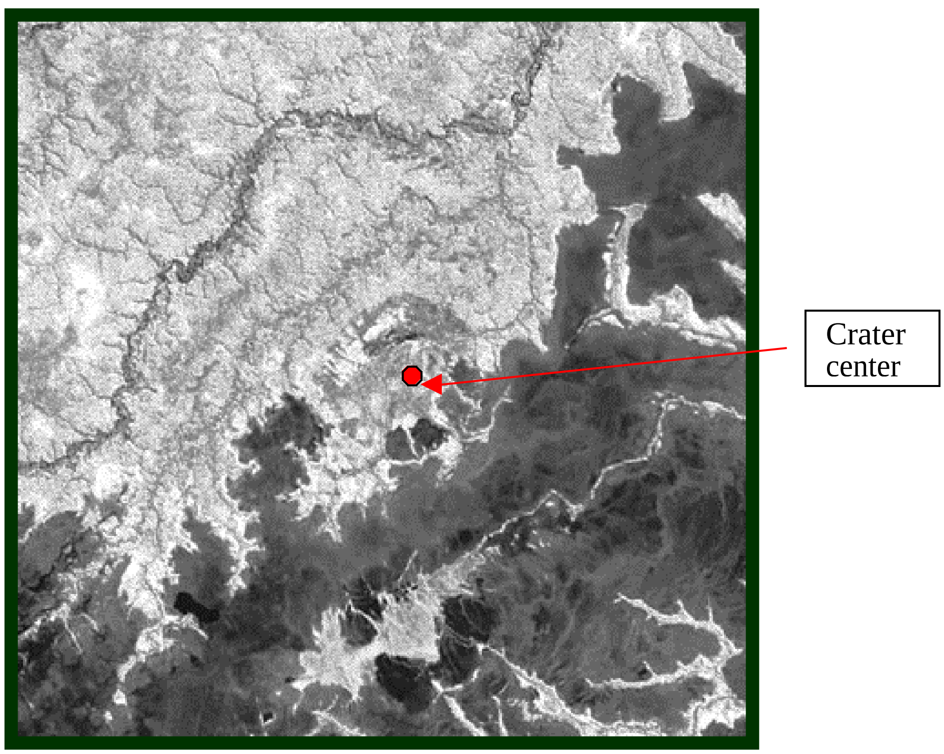
• The structure is unique to the area and indeed may be unique to the Amazon basin which is devoid of geologic expression other than that of surficial Quaternary sedimentation and fluvial erosive activity
• The structure is superimposed upon the local topography

• The depth to basement is estimated to be 3 kilometers and together with tens of meters of loose Pleistocene alluvium within which the structure lies makes it very unlikely that the structure reflects any basement expression.
• The structure is > 500 Kilometers from the nearest known volcanic or karst terrain within which circular features are sometimes found
• The general form of the structure- elevated rim, annular trough, and central uplift- is that of a complex impact structure
The above were derived mostly from the interpretation of a Landsat image

In October 1998 the first NASA expedition reached the crater impact site after traveling by jet airliner, small airplane, motor boat, dugout canoe, and finally by cutting a 15 km long trail through the forest. Field data gathered during the expedition supports the hypothesis that the circular feature is a meteorite impact crater. The rings visible on the satellite image correspond to slight ridges not more than 2 m in elevation, but sufficiently higher to support upland forest vegetation, while the interior of the crater is either inundated savanna or flooded forest.

The 8 kilometer diameter circular feature called the Iturralde structure can be clearly seen in the Landsat image

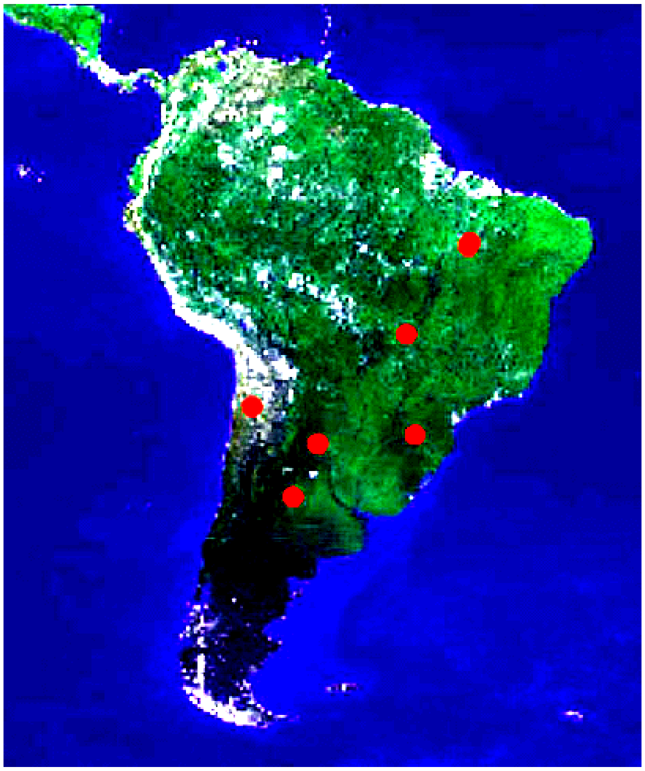
Figure 3



Please note that the center of the crater is **12 degrees 34.82 minutes South**
67 degrees 40.49 minutes West

FIGURE 4

Like all large land masses on earth, South America contains impact craters



http://www.lpl.arizona.edu/SIC/impact_cratering/World_Craters_Web/southamericamap.html

Location of the verified craters in Chile, Argentina, and Brazil. The names and locations and other details about the craters can be found at the website whose URL is located beneath the Figure. Craters are found on all the continents except Antarctica. The fact that over 15,000 meteorite pieces have been found in the Antarctic by American, Japanese, German, and Italian research teams indicates that impacts do happen in the Antarctic. Crater evidence is buried beneath the ice cover.

PERSONALITY OF THE EXPEDITION

THE EXPEDITION TEAM will be in Bolivia and the HOME TEAM will be in the USA. The HOME TEAM will consist of NASA/GSFC scientists, scientists from colleges and Universities, the teacher scientists who come from the states in the NASA/GSFC service area and from West Virginia, and others in the NASA MU-SPIN PROGRAM. The Teacher Scientist will also participate in the creation of the event resource that will be used for follow on teacher professional development. A large effort will be made to ensure that this entire project is translated into Spanish.

MU-SPIN is a significant part of this program and the MU-SPIN connection will be managed by Dr.Valerie L.Thomas.

The teacher team represents a diverse group of teachers working as scientists in proprietary collaboration with professional scientists to investigate and interpret information that will address the origin of the Iturralde structure.

The purpose of having the teacher team accompaniment to Bolivia ICE 2002 is to: (a) provide a teacher as scientist experience for the home teams who will help design the field science program and will then participate in all aspects of analysis and interpretation,and thereby, (b) enable the creation of a web based delivery format for a teacher professional development program.

MAKEUP OF THE ICE2002 EXPEDITION TEAM

ADVANCE GROUP

Teddy Marcelo Silas MNK
Vladimir Fuentes MNK
Oswaldo Mailar MNK
AND
Samuel Sangueza MNK
Raul Bustillos MNK

EXPEDITION GROUP

Dr.Peter Wasilewski GSFC/691
Dr.Compton Tucker GSFC/923
Dr.Tim Killeen MNK,CI
Peter Killeen- student Bolivia
Erin Killeen – student Bolivia
Peter Hardy
Allen Lundsford GSFC/935
David Beverly NASA/422.1 QSS(PAAC)
Dr.Gunther Kletetschka NASA/691, HU
Victoria Bruce
Photographer

MNK- MUSEO NOEL KEMPFF
CI-CONSERVATION INTERNATIONAL
NASA- NATIONAL AERONAUTICS SPACE ADMINISTRATION
GSFC- GODDARD SPACE FLIGHT CENTER
GISS- GODDARD INSTITUTE FOR SPACE STUDIES
HU-HOWARDUNIVERSITY
NSF- NATIONAL SCIENCE FOUNDATION

MU-SPIN-MINORITY UNIVERSITY SPACE INTERDISCIPLINARY NETWORK

MAKEUP OF THE HOME TEAM

Dr. Robert Gabrys head Goddard Education Office- code130.3
Dr.Valerie L. Thomas- Responsible for the MU-SPIN connection to the expedition
Malcolm Cannon MU-SPIN video clip producer
Anel Flores GSFC code713 is assisting with many aspects of the expedition
Michael Hubenthal will coordinate education efforts while the expedition is in Bolivia

Team 1: MAGNETISM TEAM

(Rosemary Milham- NASA/GSFC- AESP)
Dr. James Heirtzler GSFC
Dr. Gunther Kletetschka HU
Deborah Mirdamadi
Patt Squicciarini

Kathy Rossman
Sue Eaton
Teresa Barton

Team 2: LANDSCAPE RECONSTRUCTION TEAM
(Suzanne Kinnison- NASA/GSFC-AESP)
Dr. Elissa Levine GSFC/923
Dr. Jessica Robin
Peggy Manbeck
Rachelle Kean
Joan Tabor
Nancy Talley
Joan Johnson
Frank Woke
Pat Cushing

Team 3 CRATER SCIENCE TEAM
(Dennis Chistopher NASA/GSFC- AESP)
: Dr. Bevan French will be the advisor to the expedition regarding crater science
Dr. Sandra Holmes
Phil Pack
Len (Walter) Sharp
Susan Hoffmire
Kim Miller
Willette Harbor

Team 4 MAGPLANE TEAM
(Ron Ernst NASA/GSFC – AESP)
James Heidenberger :
George Foster
Sephanie Bennett
Glenn Reynolds
Sylvia Harris

MAGPLANE construction team
Pat Coronado GSFC/935
Kelvin Brentzell GSFC/695
Allen Lundsford

\MAGNETOMETER TEAM

Dr. Mario Acuna GSFC/695
John Scheifle
Fred Minetto
Everett Worley
Maria Kirsch
Phil Goodwin

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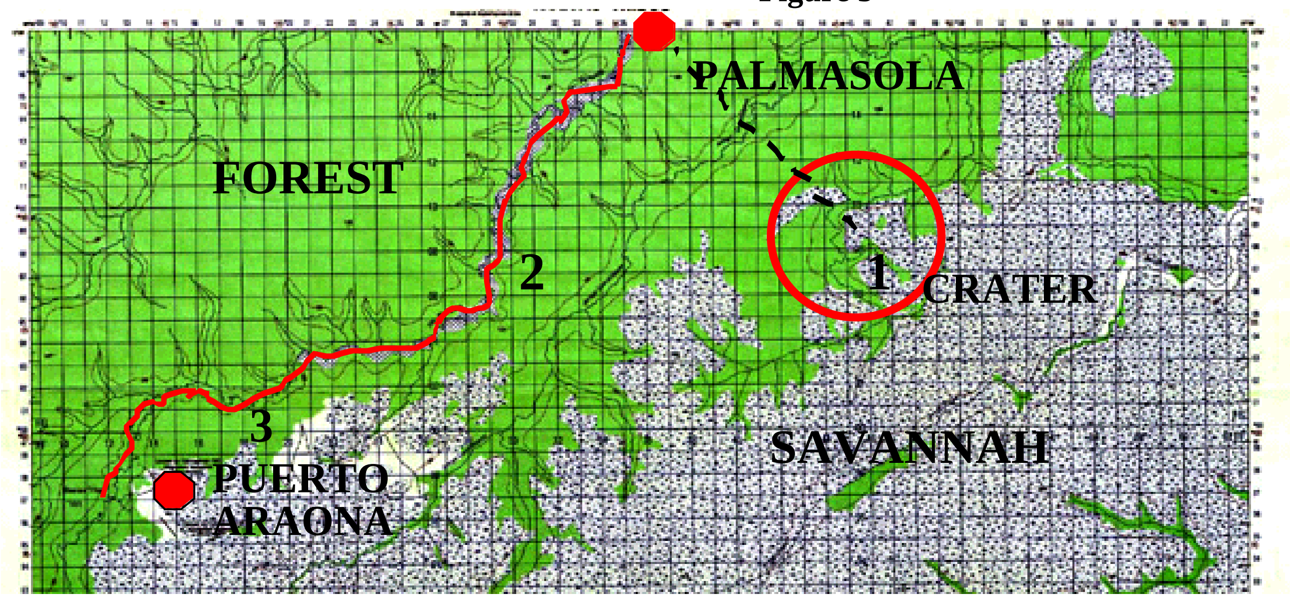
THE EXPEDITION PLAN

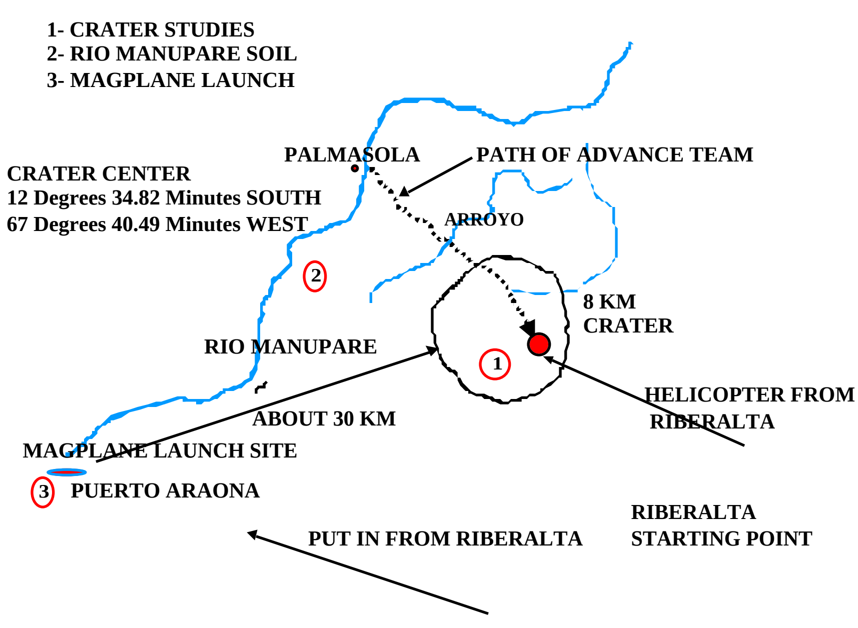
The NASA team with support from the advance team and Dr. Killeen will conduct crater studies. After completing the crater studies the teams will walk back to Palmasola. The Rio Manupare soil profile studies will be conducted out of Palmasola. Upon completion of the crater and soil studies all will travel to Puerto Araona where the MAGPLANE launch phase will commence

Figure 5



KILOMETER GRID

Figure 6



PRELIMINARY EXPEDITION TIMELINE

BASED ON THE PRIORITY AND IMPORTANCE OF TASKS FOR THE NASA MISSION

SEPTEMBER 4 **WASILEWSKI AND HARDY ARRIVE SANTA CRUZ**

SEPTEMBER 11 **TUCKER, KLETETSCHKA,BEVERLEY, LUNDSFORD, BRUCE, AND PHOTOGRAPHER ARRIVE SANTA CRUZ**

SEPTEMBER 11 **ALL GO TO RIBERALTA FROM THE AIRPORT**

SEPTEMBER 14 **WASILEWSKI, KLETETSCHKA, BEVERLEY, HARDY BY HELICOPTER TO CRATER WITH GEAR TO CONDUCT EXPERIMENTS. THE ADVANCE TEAM WILL BE IN THE CRATER**

SEPTEMBER19 **HELICOPTER REMOVAL OF SAMPLES AND GEAR FROM CRATER PASSENGERS TO BE DETERMINED-**

SEPTEMBER 22 **TO 24 SOIL WORK ALONG THE RIO MANUPARE**

SEPTEMBER 25 **ASSEMBLE THE MAGPLANE. AND BEGIN THE MAGPLANE FLIGHTS.**

CRATER TO THE INTERNET

An Inmarsat M4 telephone will enable communication from the NASA TEAM to the internet. The 64kbps data transfer rate will allow images and data to be sent from this remote site. The M4 will also be available for emergency communication if needed. Since the expedition will now take place while the schools are in session we will likely have some webcasting

TENTATIVE WEBCAST ITINERARY-- MICHAEL HUBENTHAL together with AESP supervisors and the scientists will be responsible for the Home Team connection

SEPTEMBER 13 FROM RIBERALTA

SEPTEMBER17 FROM CRATER

SEPTEMBER 23 FROM RIO MANUPARE OR FROM PALMASOLA

SEPTEMBER 26 FROM MAGPLANE LAUNCH

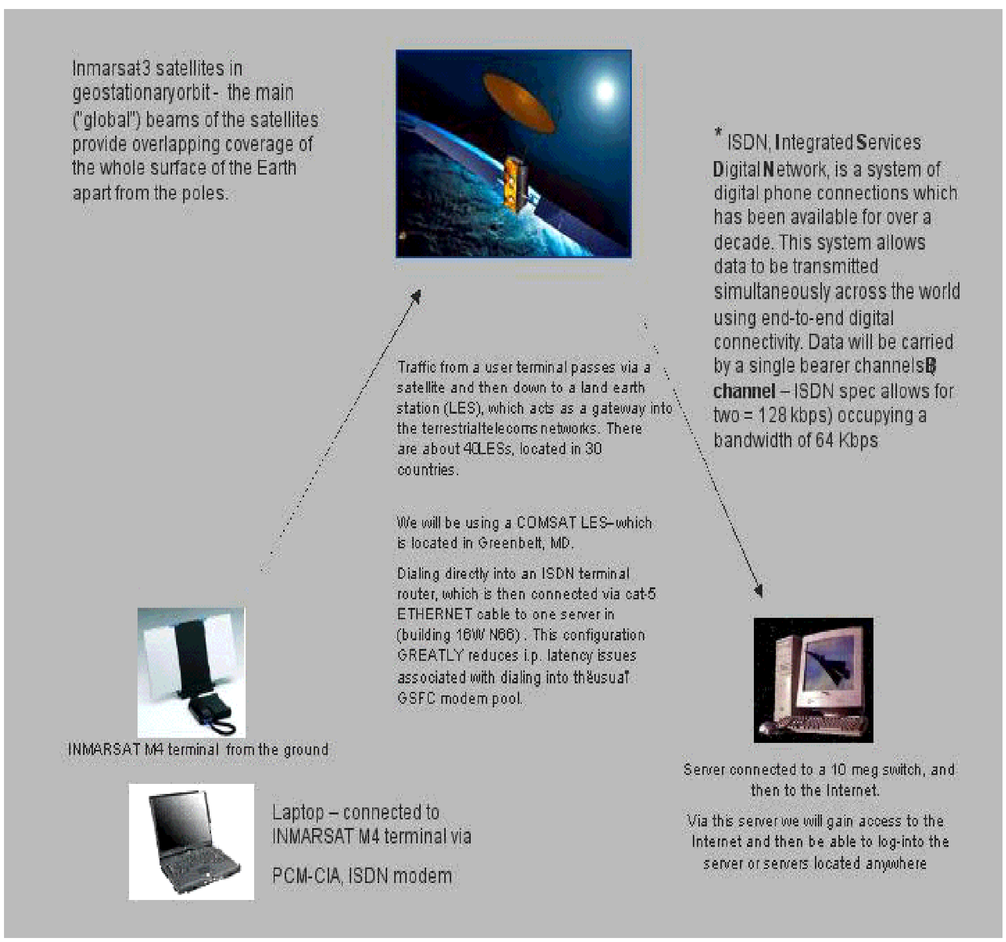
Information that will be sent to the web from Bolivia

PHASE 1 ITURRALDE STRUCTURE
- SCINTREX MAG DATA
- MEDA MAG DATA
- SOIL CHARACTERIZATION
- LAND CLASSIFICATION
- TEXT FROM SITE
- IMAGES FROM SITE
- ALTA SPECTRA-

PHASE 2 RIO MANUPARE
- SOIL CHARACTERIZATION-
- LAND CLASSIFICATION-
- TEXT FROM SITE
- IMAGES FROM SITE

PHASE 3 MAGPLANE LAUNCH
- MAGPLANE MAG DATA
- MAGPLANE GPS DATA
- BASE STATION MAG DATA-
- TEXT FROM SITE
- IMAGES FROM SITE

FIGURE 7 The INMARSAT connection to the web



A unique addition –The MAGPLANE

MAGnetometer **PLANE- MAGPLANE** was added to the expedition plan to enable the mapping of the magnetic field that might be associated with the Iturralde structure. We recognize that a detailed ground traverse program across the Savannah and through the rainforest would be arduous. Peter Wasilewski on the suggestion of Dr. Robert Gabrys s communicated with Pat Coronado who at the time was doing some work with the Goddard education office where the UAV's (unmanned aero vehicle) were to be used with education projects. Peter convinced Pat that a crater magnetic survey would be ideal for his UAV's and the contained technology. Essentially a test for his team and gear that had not been done before. Once Peter described the mission to Dr. Mario Acuna who subsequently came on board with his magnetometers, the MAGPLANE mission had a strong sense of credibility.

Below is the 1/3 scale piper cub with a wingspan of about 12 feet that will be the MAGPLANE. This plane was chosen because it is the largest available radio control plane with a takeoff weight of about 16 kilograms. The choice was made to launch from the compacted soil strip near the New Tribes mission which is contiguous with the Araona Puerto Araona village

http://www.globalhobby.com/modeltech/121200.htm

The size of the MAGPLANE compared to the man **Figure 8**

Figure 9 The MAGPLANE MAGNETOMETER
Being created by Dr. Mario Acuna

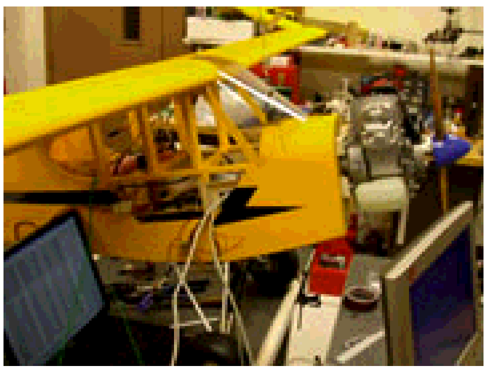


Figure 10 Engineering model of the MAGPLANE on the occasion of the mating of the magnetometer with the onboard systems.
Incremental turn-ons enabled an assessment of level of noise experienced by the wingtip mounted magnetometer

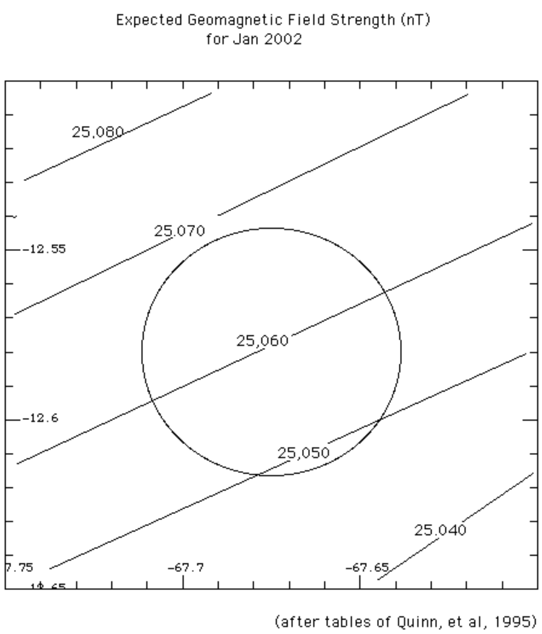
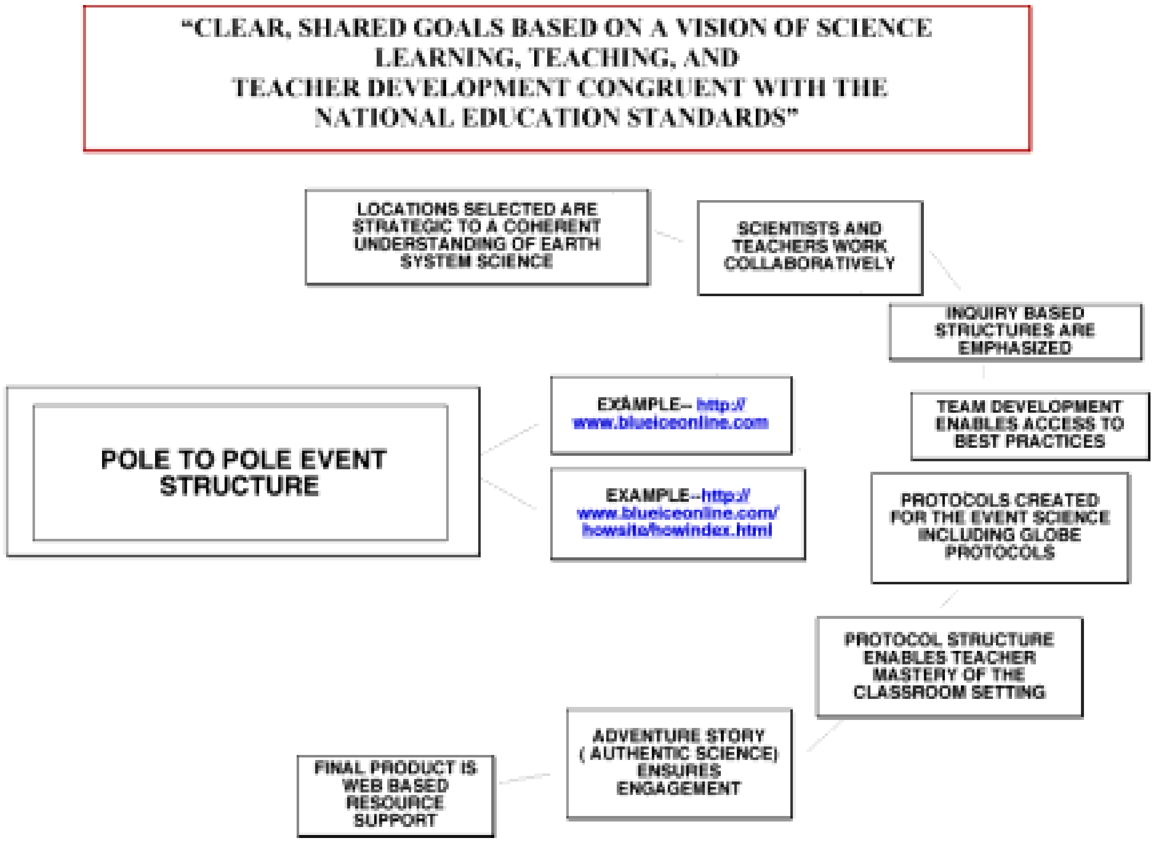


FIGURE 11 The estimated total intensity of the geomagnetic field at the location of the Iturralde structure. This Figure is due to Dr. James Heirtzler

FIGURE 12- The OUTLINE plan of the Teacher/scientist collaboration This is a model that will evolve as the teacher teams become an active part of the expedition



The inquiry –based teaching method is embedded in the Teacher/scientist professional development program. Below are extracts from the HOW teacher/scientist component. HOW is another of the teacher/scientist events. Teachers emerge competent to engage the inquiry methodology because they understand it intellectually and at the hands-on level which may be more important

IMPLICATIONS OF INQUIRY-BASED TEACHING METHODS IN THE SCIENCE CLASSROOM

Tom Alena, Seth Bonnett, Cynthia Brisson, David Cox, Ken Huff, Nathan Poore, Kathy Rossman, Jerry Roth, and Valerie L. Thomas.
February 22, 2002

http://www.blueiceonline.com/howsite/howindex.html for HOW background.

"…………..Inquiry-based learning is defined as research with guidance that allows the learner to formulate an investigable question and compile the data necessary to arrive at a logical conclusion. This is accomplished by providing sufficient information to students allowing them to examine resources related to their observations and measurements. The students act as scientists by learning to use the tools related to data collection, investigate natural phenomena by keeping accurate records of their data acquisition, and providing a logical interpretation of their results. Adequate instruction is provided in a hands-on environment where the learner is exposed to, and instructed on, the use and calibration of the tools used in data collection. Instruction is not initially provided as to why the instruments are used or how the data is to be interpreted. The focus is on correct use of the instrumentation to gather data relating to the topic at hand.

It should be noted that the classroom using inquiry is work-intensive for both instructor and student alike. Instructors need a high level of knowledge in the content area being examined. Those instructors new to inquiry-based learning should be prepared for additional workload because the nature of the inquiry-based classroom requires extensive preplanning and precludes the predictability found in the traditional classroom. Be prepared to leave your zone of comfort. Different sections of the same class may have different questions and perhaps even a different focus on the results. For the students, an inquiry based classroom presents a challenge since it may be the first time a student has had to deduce results instead of having results presented to them in a lecture.

The advantages of inquiry-based learning are that it provides a greater conceptual understanding of the content, and allows for the application of the concepts to different subject areas of science. Inquiry promotes cooperative learning, logical thinking, and problem solving skills. It also enhances the responsibility and accountability of the student by requiring regular journal entries detailing work completed and reflective evaluations of the student's work.

Inquiry-based instruction also has significant benefits for teachers. It fosters differentiated instruction and allows concepts to be taught to mixed-level classes all the while addressing the student's individual needs. Different roles in groups allow students to work within their areas of strength- students with artistic talents can sketch field observations, concrete learners can analyze data, and kinesthetic students can be performing the experiments.

Our fieldwork in the HOW program allowed us to experience all facets of inquiry-based learning. Events throughout the week highlighted the importance of accurate journaling, and the detailed recording all observations. Ice-sampling protocols were not well understood, which resulted in incomplete data collection from two of the sites. Over the week techniques and sampling become more concise and effected a clear analysis of test results and variables ultimately resulting in the acceptance and rejection of hypotheses. Frequent checks must be made to ensure that no steps are skipped and no data goes unrecorded. Renewed emphasis on these skills allowed us to carry out authentic science.

Our inquiry-based experience also fostered a dialogue with our peers. We found that through this communication, a deeper understanding of both the context and the process evolved. This honing of ideas through reasoning allowed us to clarify points of agreement and disagreement. An un-calibrated scale used to measure snow water equivalency was a source of continuous debate amongst group members. Group members made numerous mathematical checks and comparisons with no consensus being reached. Through discussion and direction from our primary instructors, we were able to recognize that these results needed to be discarded. This situation illustrates the need for continued communication amongst group members and with the teacher or instructors.

Double-checking the results and protocols of experiments is another important aspect of inquiry. The students are required to be continually thinking of and recording explanations of what they are learning. They have to look at their entire experiment with a critical eye and keep refining both variables and procedures. This includes identifying errors generated by instrument error and finding other methods to verify their results.

Inquiry simulates real world applications of skills used daily by professionals and experts in many fields of study. Problem solving, collaborative work ethic, peer observations, and recognizing trends are some of the many derived from inquiry. These skills are necessary to prepare students for secondary education and careers. If these skills are not developed and encouraged during students schooling they will very often have to learn these skills without the benefit of an instructor to direct their learning.

Inquiry is an essential component of an effective science education. With inquiry based instruction students are scientists. This process allows students to construct explanations for natural phenomena with minimal guidance. Proper protocols and accurate data collection become a part of their science education and helps the student refine their thinking. By taking a more active role in their own learning, students gain a better understanding of the content as well as making additional connections to the world of science. …………"

INITIAL STEPS BY THE I.C.E. 2002 TEACHER TEAMS

The following Questions/Comments from teachers developed from the teacher to teacher interactions which were stimulated by hands-on experience with the instruments that will be used in Bolivia and the scientist presentations which addressed the use of the instruments

GPS readings are needed of all samples taken in Bolivia to keep track of data collected.

Landscape Reconstruction & Soils:

- Profiles need to be collected where a diversity of samples is expected. The general consensus is that those working in field will have to use good judgments in making these decisions.
- Soil profiles need to be taken both inside and outside the crater. The profiles need to be taken on the rim, in the center of crater, forest region, grassland region, and the transition area between forest and grassland.
- A Digital Camera needs to be used to record all soil samples. A White Plastic Bag should be used for the background of all soil pictures**.**

- One area of great interest is the stream running through the crater. Soil profiles near the stream may show diversity. If possible, the team needs to sample in the area of the stream in the crater and outside the crater. This area needs to be examined for differences from other areas.
- Due to the limited availability of rock, all rocks need to be collected or examined for cratering characteristics. The weathering of rocks due to the weather conditions in Bolivia makes even collecting small pebbles important.
- One idea is to investigate all anthills. Use a hand lens to look at materials brought up by the ants looking especially for the presence of any type of rock material.

Flora and Fauna:

- Globe protocols will be used to verify the Landsat image of the vegetation.

• Diversity and changes in vegetation need to be recorded. Digital cameras need to be used whenever possible to bring back images of the vegetation.The site team will need to judge the best sites to show diversity of vegetation.
• Sample areas should parallel those listed above under Landscape Reconstruction & Soils.
• Fauna should be recorded with digital pictures taken when possible.
• Species diversification and change is what needs to be examined. Is there any noticeable difference between flora and fauna outside and inside the crater?

Crater:
• Elevations are needed of a) the rim; b) the area outside the crater; c) the area inside the crater (especially at the center).
• What is the water flow in the crater during the wet season? Can anything be determined from the paths water takes? Is there a noticeable area of change from these waterflows?

Magplane:
• The Magplane should fly first over the center of the crater and then work out from there. The most important passes should happen first in case of problems develop later with the magplane.
• Teachers are looking forward to seeing the images from the magplane. Pictures from the canopy will be unique.

Magnetism:
• Magnetometer readings need to be corrected for background.
• Dropping magnets into soil samples holes was suggested. The hope is to bring up any magnetized rocks.
• Practice data is needed to compare to data received from the crater.
• Analysis and understanding of the data is a concern for the teachers.

Other questions:
• How are we supposed to communicate with the field team
• When and how are we supposed to bring in other educators?

Future expedition ideas:

• Gravity meter needs to be taken into the region to determine depth of the crater. This data is needed for analysis.
• Echo sounding might be considered for future expeditions.
• A tether balloon for above the treetop observations was a suggestion.

In contrast to the HOW event where teachers were involved with hands-on activity, ICE2002 will have the teachers remoteely connected with the exploration and experimentation. Consequently they must cooperatively consider the information coming to the website from Bolivia and work as a team . The team leader then will interact with the bexpedition. This is akin to a remote science experiment.

FIGURE 13 - PLAN FOR THE EXPEDITION DESIGN AND INTERNET TECHNOLOGY UTILIZED BY THE EXPEDITION. INCLUDED IS THE BACKGROUND FOR THE INDIGENOUS ARANOA

FIGURE 14 - THE PLAN FOR THE RESOURCE THAT WILL BE DEVELOPED FROM THE CONTENT COMING FROM THE EXPEDITION

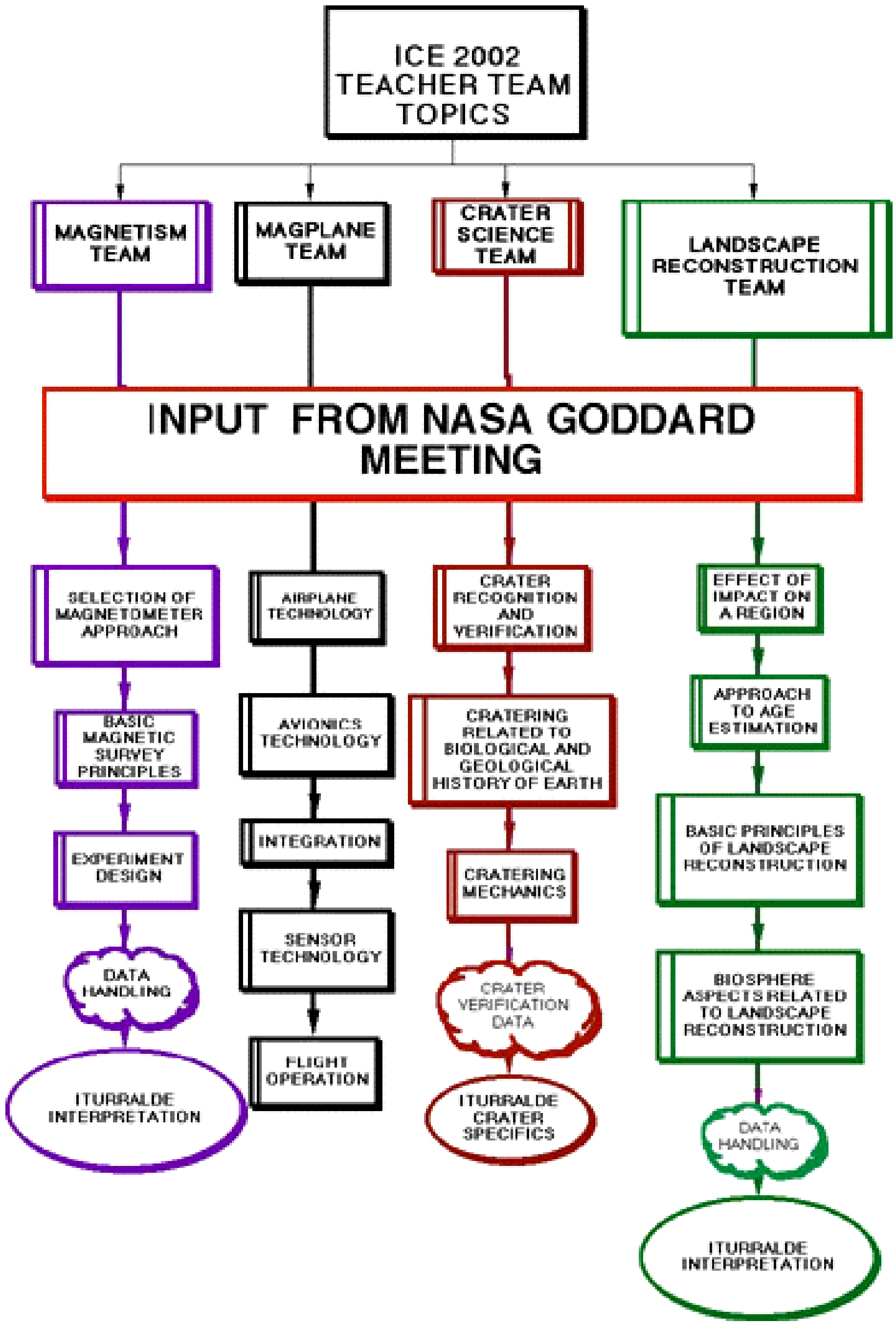
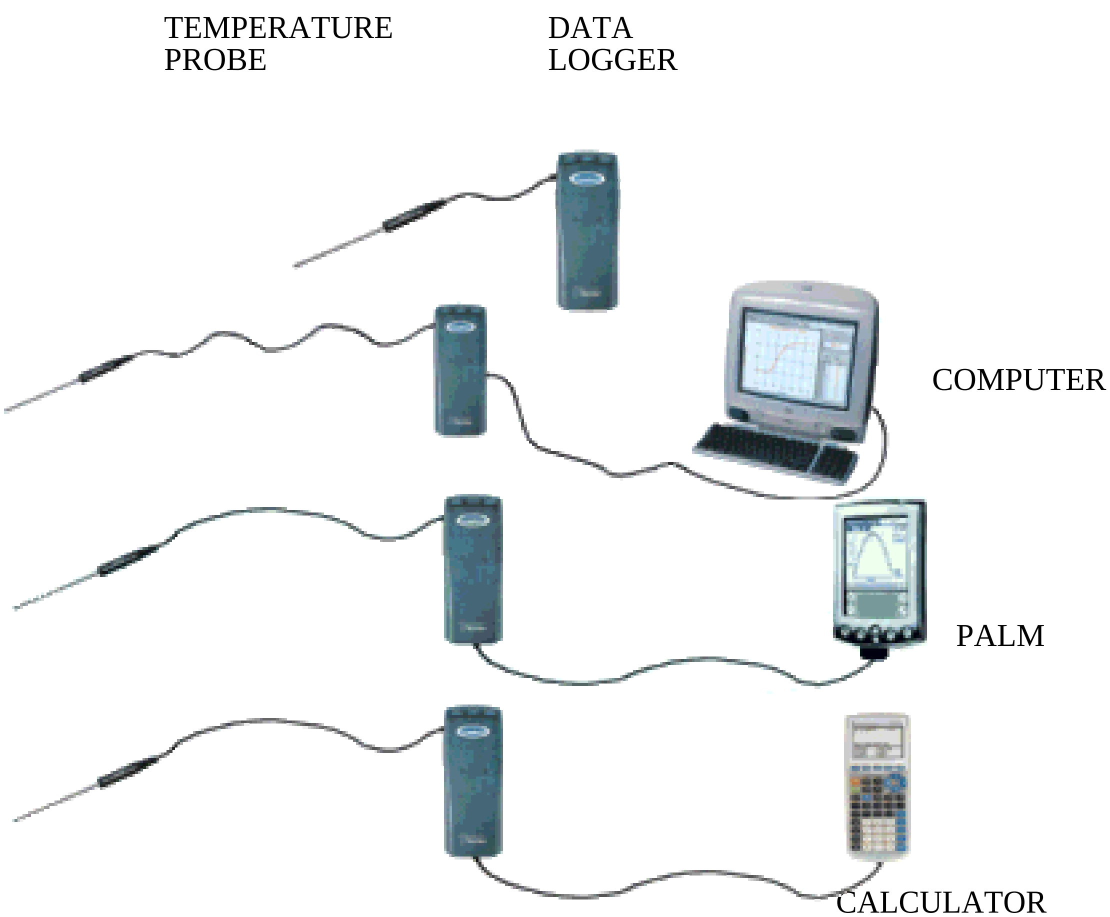


FIGURE 15 - Vernier tools will be used in Bolivia

Vernier temperature probe in the possible real- time data collection configurations. The data logger can be used as a stand alone or can be connected to computer (MAC or PC), PALM, or TI CALCULATOR. A wide variety of the Vernier probes will be used to collect data in Bolivia. Where GLOBE type data is required the Vernier probes will be used. We will be using these probes in extreme remote conditions to demonstrate their utility in any condition. The information will be sent to the web from the remote Bolivia sites.



All graphics and textual information with permission of Vernier
http://www.vernier.com

TEACHER/SCIENTIST - HOME TEAM WEB STUDIES

Information about the 1998 expedition and stable carbon isotope analyses of soils collected during the 1998 expedition can be found at:
http://www.mobot.org/MOBOT/research/bolivia/craternew/welcome.htm

SOIL SCIENCE SITES
http://www.globe.gov
http://ltpwww.gsfc.nasa.gov/globe/index.htm
http://www.soils.umn.edu/academics/classes/soil3125/doc/labunts.htm
http://www.statlab.iastate.edu/soils/photogal/
http://homepages.which.net/~fred.moor/soil/links/l01.htm

IMPACT RELATED SITES:
http://www.lpl.arizona.edu/tekton/crater.html
http://208.154.71.60/bcom/eb/article/single_image/0,5716,3304+asmbly%5Fid,00.html
http://www.geophysics.dias.ie/~gkenzie/chix/cratering/sld001.html
http://www.gi.alaska.edu/remsense/gisp/candc.htm
http://www.geologi.uio.no/avdG/mjolnir/mjolnir.html

THE WEB SITES BELOW WERE CREATED FOR THE 1998 EXPEDITION.
http://svs-f.gsfc.nasa.gov/imagewall/LandSat/araona_crater.html
http://www.gsfc.nasa.gov/gsfc/bolivia/bolivia.htm
http://www.gsfc.nasa.gov/news-release/releases/1998/98-169.htm
http://education.gsfc.nasa.gov/experimental/all98invProject.Site/Pages/science-briefs/ed-taliaferro/iturralde.html
http://education.gsfc.nasa.gov/experimental/all98invProject.Site/Pages/bolivia-webpage/crater.html
http://www.mstanea.org/bolivia.html
http://www.globe.gov/fsl/html/templ.cgi?levine_meteor&lang=en&nav=1
http://sdcd.gsfc.nasa.gov/DIV-NEWS/Accomps.2001.09.html
http://listserv.plymouth.edu/pipermail/nhsci-ed/2001-December/000134.html
http://edmall.gsfc.nasa.gov/inv99Project.Site/Pages/science-briefs/ed-taliaferro/iturralde.html
http://education.gsfc.nasa.gov/experimental/all98invProject.Site/Pages/boliviapage.html
http://education.gsfc.nasa.gov/experimental/all98invProject.Site/Pages/bolivia-webpage/getinvolved.html

MAGNETIC SURVEY DETAILS
http://www.georentals.co.uk/ampm-opt.pdf This site contains all manner of preliminary information about the magnetometer technique.

MAGPLANE FLIGHT related
http://www.ueet.nasa.gov/StudentSite/
http://www.grc.nasa.gov/WWW/K-12/airplane/bga.html
http://www.grc.nasa.gov/WWW/K-12/airplane/bgp.html